FARMERS' USE GAP ON RECOMMENDED DOSE OF FERTILIZER AND PESTICIDE IN WHEAT CULTIVATION

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FARMERS' USE GAP ON RECOMMENDED DOSE OF FERTILIZER AND PESTICIDE IN WHEAT CULTIVATION

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CERTIFICATE

This is to certify that the thesis entitled ***"Farmers' Use Gap on Recommended Dose of Fertilizer and Pesticide in Wheat Cultivation"*** *submitted to the faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE in AGRICULTURAL EXTENSION AND INFORMATION SYSTEM, embodies the result of a piece of bona fide research work carried out by Md. Sayem Mahmud, Registration Number 14-05905 under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.*

I further certify that such help or source of information, as has been availed of during the course of this investigation has been duly acknowledged by him.

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DEDICATED TO

MY

BELOVED PARENTS

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The Author

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ABSTRACT

The purpose of the study was to determine the extent of use gap in use of fertilizers and pesticides in wheat production among the wheat growers of Thakurgaon district and to explore the contributing relationships between the selected characteristics of the wheat growers and their use gap in use of recommended dose of fertilizers and pesticides. The study was conducted at four villages of three unions in Thakurgaon Sadar upazila. Data were collected from 100 wheat growers by using a pre-tested interview schedule during the period from November 01 to December 01, 2021. The findings revealed that the highest proportion (49%) of the wheat growers had low use gap on fertilizer and pesticide use as compared to no use gap, medium use gap, and high use gap at the rate of 3%, 30%, and 18%, respectively. Among the nine selected characteristic, five variables, namely education, wheat cultivation experience, time spent in farming, use of information source and training duration were found to have a significant influence to the use gap in using recommended dose of fertilizers and pesticides at both 1% and 5% level of significance. The concerned authority should consider the significant variables in reducing farmers' use gap on recommended dose of agrochemicals like fertilizer and pesticide.

CHAPTER I

INTRODUCTION

1.1 Background of the Study

Bangladesh is an agricultural country. Agriculture is the single largest producing sector of the economy and contributes about 13.02 % to the total Gross Domestic Product of the country. This sector accommodates around 40.6% (in 2016-17) of labor force. Agricultural holding in Bangladesh is generally small but use of modern production technologies and equipment are gradually has been increasing. Rice, jute, sugarcane, potato, vegetables, wheat, and maize are the principal crops of Bangladesh. Crop diversification program, credit supply, extension work, research and input distribution policies pursued by the government are yielding positive results (BBS, 2020).

Wheat is the third most important cereal grain in Bangladesh (Sarwar and Biswas, 2021). Around 0.765 million tons' wheat is produced in the whole world (FAO, 2021). In Bangladesh, the areas under wheat crop were estimated at 1,016,811 and 1,029,354 ha in 2018-19 and 2019-20, respectively (Table 1.1). The total production of rice in Bangladesh is not sufficient to feed people. Wheat can be a good supplement of rice and can play the most vital role to feed millions of the people. Also, there is ample scope for wheat cultivation in Bangladesh as it is cultivated in rabi season having minimum competition with rice for land. Wheat can be grown in winter season along with other crops like pulses, oil seeds etc. There are five wheat production zones have been identified in Bangladesh. The North-West (N-W), North-East (N-E), North Central (N-C), South Central (S-C) and South West (S-W) zones include most of the major wheat producing areas in the country. The majority of the areas under wheat cultivation is found in the northern part is the most important wheat growing area (Zahan, 2010).

Table 1.1: Production of wheat

Year	Production (M. tons)	Area (hectare)
2018-19	1,016,811	3,30,348
2019-20	1,029,354	3,32,274

(Source: BBS, 2020)

The northernmost district of Thakurgaon is prominently known for its wheat production. One-fifth of the country's wheat production is produced in this district. But Farmers of Thakurgaon have been losing interest in wheat cultivation for the last four years. DAE officials found out one probable reason behind this. The reason is the lacking of proper knowledge in using recommended dose of pesticides during the frequent attack of pests (Milu, 2021). Another probable reason indicated by Yaduvanshu (2003) is the lack of proper knowledge in fertilizer management. Therefore, Farmers' expertise in the optimal management of pesticides and fertilizers could sustain the pride of producing the highest amount of wheat in the Thakurgaon district.

1.2 Statement of the Problem

Wheat is one of the most important cereal crops in Bangladesh next to rice. The importance of the cultivation of this crop is increasingly recognized by the implement as of agricultural extension programs as well as policy makers. The government of Bangladesh is promoting the extent of cultivation and production of this crop through various projects. As a high value crop, wheat has much potentiality for widespread cultivation by the respondents. But before undertaking any massive program for its increased cultivation in Bangladesh, firstly, it is necessary to know the existing situation of the extent of wheat cultivation in the most potential areas of Bangladesh. The Thakurgaon region is mostly well known for cultivation of wheat in this country. To expand the cultivation of this crop, the knowledge on the different technologies used in

wheat cultivation should be known thoroughly to design appropriate programs for its widespread cultivation. Knowledge gap refers to the extent of gap of understanding and skills on different dimensions of wheat cultivation. Among the wheat cultivation technologies, fertilizers and pesticides are the most important ones. If farmers' have knowledge gap on use of recommended dose of fertilizer and pesticide, they may use excess or inadequate dose of these agrochemicals. Excess use of the agrochemicals could affect plant-environment system, whereas, inadequate use could disrupt the growth and development of wheat.

Analyzing the issues from wheat growers' perspective, this study was designed to find out the following research questions about wheat growers' knowledge gap in use of fertilizers and pesticides on wheat cultivation:

1. What is the extent of knowledge gap in use of recommended dose of fertilizers and pesticides among the wheat growers?
2. What are the characteristics of the wheat growers?
3. Is there any contributing relationship among selected characteristics of the wheat growers and their knowledge gap in use of recommended doses of fertilizers and pesticides?

1.3 Specific Objectives of the Study

The following objectives were formulated to give clear direction to the study:

1. To assess the knowledge gap among wheat growers regarding recommended dose of fertilizer and pesticide application
2. To describe the selected characteristics of wheat growers.
3. To explore the contributing relationship between the knowledge gap of wheat growers in use of recommended doses of fertilizers and pesticides and their characteristics.

1.4 Justification of the Study

To increase agriculture production and maintain soil fertility, the application of chemical fertilizers is indispensable. When chemical fertilizers are used in excessive quantities to raise yield of wheat, they disrupt the physiological system of the wheat plants and come along with other numerous environmental hazards. However, insufficient or unnecessary application of fertilizer does not guarantee consistently growing yields, which can result in low efficiency of nutrient usage (Bisht and Chauhan, 2020).

Today, the key goals are the study of the effective use of agrochemicals like fertilizers and pesticides, the reduction of production costs and the efficient use of fertilization. To achieve the goal, the first and foremost important thing is to inform farmers and make them knowledgeable about the necessity of using recommended dose of fertilizers and pesticides in wheat cultivation. This necessity has been summarized in a study conducted by Hossard *et al.* (2014). In the study, they have shown that 50% reduction in the pesticide dose from the recommended dose can cause yield loss between 5 to 10%. In addition, Wang *et al.* (2011) reported that excessive or under use of fertilizers in wheat cultivation decreases wheat grain yield and increase fertilizer loss from the wheat-soil system. Therefore, assessing the knowledge gap of wheat growers regarding the optimal use of fertilizer and pesticide is the most important goal today for increasing wheat yield against the decreasing yield loss trend in Thakurgaon district.

Very few or no researches have been conducted in Thakurgaon district to determine the knowledge gap of the wheat growers regarding the use of recommended dose of fertilizer and pesticide. Therefore, the current study was conducted to fill the research gap.

1.5 Scope of the Study

The main focus of the study was to determine knowledge gap in use of recommended doses of fertilizers and pesticides. The findings of the study will be specifically applicable to Thakurgaon District. However, the findings willalso have implications for other areas of the country having relevance to

the

socio-economic context of the study area. The researcher believes that the findings of this study will disclose the phenomenon related to technological gap and knowledge gap of innovation. These will be of special concern to the policy makers and planners for formulating and redesigning the extension programs specially for wheat cultivation. These findings are expected to be helpful to the field workers of different nation building organizations and departments related to wheat production with a view to develop appropriate extension strategies for effective wheat production. Also, these will be of special interest to the policy makers and planners in formulating and redesigning the extension programs.

1.6 Assumptions of the Study

An assumption is the supposition that an apparent fact or principle is true on the light of available evidence (Goode and Hatt, 1952). The researcher had the following assumptions on his mind while undertaking this study:

1) Almost all the respondents were more or less conscious about the use of wheat cultivation.
2) The respondents who were included in the sample was capable of providing proper answer to the question in the interview schedule.
3) The researcher acted as interviewer was adjusted to social and environmental condition of the study area. Therefore, the data collected by him and the respondents were free from bias.
4) The responses furnished by the respondents were reliable and they expressed the truth about their conviction and opinions.
5) Views and opinions furnished by farmers included in the sample were representative views and also opinions of the whole population of the study.
6) The finding of the study will have general application to other parts of the country with similar socio-economic, cultural and agro-ecological conditions of this study area.

1.7 Limitations of the Study

Considering the time, money as well as other necessary resources available to make the study manageable and meaningful, it was also necessary to consider the following limitations:

1. The study was confined mainly to farmers' knowledge gap of wheat cultivation.
2. The study was confined only in Sadar upazila of Thakurgaon district.
3. The characteristics of wheat growers are many and varied but only nine characteristics were selected for investigation in this study.
4. Population of the study have only included the heads of the farm families.
5. Facts and figures were collected by the investigator applied to the present situation in the study area.
6. For information about the study, the researcher was dependent on the data furnished by the selected respondent in the time of data collection.

1.7 Definition of Key Terms

A concept is an abstract of observed thing; events or phenomenon or in other words, it is a short hand representation of variety for facts (Wilkinson and Bhandarkar, 1977). A researcher needs to know the ultimate meaning and contents of every term that he uses. It should clarify the issue as well as explain the fact to the investigator as well as readers. Hence, for clarity of understanding, a number of key concepts/terms frequently used throughout the study defined are interpreted as follows:

Innovation

An innovation is an idea or practices perceived as new by the individual. It is the newness of the idea to the individual that determines his reaction to it.

Farmers/Growers

The persons involved in farming activities are called farmers. They participated in different farm and community level activities like crops, livestock, fisheries and other farming activities etc.

Innovativeness

It is the degree to which an individual is relatively earlier in adopting agricultural innovations, new ideas, practices and things than the other members of a social system. This was comprehended by the quickness of accepting innovations by an individual in relation to others as well as was measured on the basis of time dimension

Agricultural knowledge

It is the extent of basic understanding of the farmers in different aspects of agricultural subject matters i.e., crops, livestock, agroforestry, soil, seed, fertilizer, insects and diseases of crops, high yielding variety etc. It also includes the basic understanding of the use of different agricultural inputs and practices.

Respondents

People who answered questions by an interviewer for a social survey. They are the people from whom a social research worker usually gets most data required for research.

Variable

A general indication in statistical research of characteristic that occurs in a number of individuals, objects, groups and that can take on various values, for example the age of an individual.

Assumption

The assumption is “The supposition that an apparent fact or principle is true in

the light of the available evidence" (Goode and Halt, 1952).

Hypothesis

It is defined by Goode and Halt (1952), a proposition this can be put to "a test to determine its validity". It can be true or false, it may seem contrary to or in accord with common sense. So, it leads to an empirical test.

Null hypothesis

The hypothesis which we pick for statistical test is null hypothesis. In this study the null hypothesis is stated that there is no relationship among the concerned variables.

Use gap

A use gap is a discrepancy between what is known and what should be known. This can be achieved through tackling previous studies to identify what is missing in either methodology, theory and literature in general.

Agrochemicals

Agrochemicals are any chemical used in agriculture, including chemical fertilizers, herbicides, and insecticides. Most are mixtures of two or more chemicals; active ingredients provide the desired effects, and inert ingredients stabilize or preserve the active ingredients or aid in application.

CHAPTER II

REVIEW OF LITERATURE

The purpose of this Chapter is to review the literatures having relevance pertinent to the present study. The researcher made an exclusive search of available literature for the above purpose. But there is hardly any study dealing with the relationship of the characteristics of growers and their adoption of selected wheat cultivation by the wheat cultivator. The researcher attempted to search the literatures on a number of studies have been conducted on the knowledge gap by the wheat growers. Thus, the finding of such studies related to the extent of adoption of selected wheat cultivation by the wheat growers and other partial studies have been reviewed in this chapter.

2.1 Wheat farmers' use gap on agrochemicals

Zahan (2010) conducted a study to determine the extent of use gap in use of wheat production technologies including the use of recommended dose of fertilizers among the wheat growers of Rangpur District. The study was conducted in three villages of Mominpur union under Sadar upazila and Lohanipara union under l3 adarganj upazila each. The findings revealed that the 52% of the farmers had low knowledge gap in use of recommended dose of fertilizer, whereas, 47% had medium to high knowledge gap.

An experiment was conducted to examine the extent of adoption of modern technology in Bangladesh and knowledge gap of the farmers about the technology. The farmers found to have moderate knowledge gap in most of the practiced wheat cultivation technology. However, high knowledge gap was observed for recommended fertilizer dose. There was significant difference between the recommended and the used dose (Kamruzzaman *et al.*, 2001).

A study was conducted to determine fertilizer use gaps between current farmers' practice and scientific recommendations, explore the agro-socio-economic factors affecting fertilizer use decision and nutrient use gaps at farm levels, and

investigate the major barriers to adoption of recommended fertilizer dose. The study revealed that farmers applied different types of fertilizers/ nutrients without considering scientific recommendations. They used much higher doses/over doses of all types of nutrients (NPKS) in high value crops like potato and watermelon, whereas used lower amounts in Kharif season crops like, T. Aman, maize and wheat etc. (Miah *et al.,* 2019).

Rahman (2003) conducted a study on farmers' use gap in use of pesticides. Cultivation cereal crops including wheat are the prime determinants of pesticide use. Farmers seem to treat pesticides as substitutes for fertilizers, indicated by the positive influence of fertilizer prices on pesticide use. Pesticide use is higher in underdeveloped regions. Sharp regional variations also exist in pesticide usage. Major policy thrusts for devising pesticide regulation and effective implementation, increasing farmers' awareness of the effects of pesticide use, and expansion of IPM practices are suggested to safeguard poor farmers in their pursuit of agricultural livelihoods.

Mou *et al.* (2019) conducted a study to explore the farmer's level of adoption of recommended fertilizer dose in field. The result showed that majority of the respondents (62.5%) showed high positive attitude towards adoption of recommended fertilizer dose. About half of the respondents (43.3%) belonged to medium practice category of recommended fertilizer dose in the field. In addition, 36.66% land is not under recommended fertilizer dose application which significantly differ from the amount of land under recommended fertilizer dose application.

Juliana *et al*. (1991) had undertaken a study on adoption of integrated pest management practices in five villages of vasusdevanallar block in Tirunelvi district, Tamilnddu, India. They found that about 50 percent of marginal farmers, 47.50 percent of small farmers and 52.50 percent of big farmers had medium adoption and 42.50 percent of big farmers, 22.50 percent of small farmers and 5 percent of the marginal farmers had high level of adoption in their research. In

both adoption and use gap level of big farmers' participation was higher in comparison to other categories of farmers.

Farmers must use pesticide to keep crops safe from pests, insects, but they are not aware of applying pesticide in respect of when to apply and in what amount to apply. These use gap of the wheat growers have been creating residual effect in wheat growing fields that ultimately affecting wheat production (Ahmed, 2015).

2.2 Relationship between farmers' characteristics and use gap

Kashem *et al.* (1992) had done a study on the use of communication media in adopting agricultural technologies such as pesticide and herbicide. They reported that age was significantly related to the use gap of using technology of rice cultivation.

Yang et al. (2015) was conducted a study in five counties in East-Central China to study farmers' fertilizer application behaviors, decision-making processes, attitudes towards adopting better fertilizer application technologies, and environmental consciousness. The survey results revealed widespread fertilizer misapplication and highly variable application behaviors in the study regions. The lack of scientific knowledge on fertilizers and the absence of guidance from agricultural extension services have forced the farmers to rely on personal judgment and advice from fertilizer dealers and friends to make decisions in fertilizer application in wheat, maize etc. Overall, farmers have been idiosyncratic in fertilizer application with limited adoption of better fertilizer application technologies. There are great potentials for reducing pollutant load from agricultural runoff through promoting scientific fertilizer application in the regions. However, farmers' diverse preferences over agricultural extension programs necessitate an integrated approach emphasizing farmer involvement throughout the development of such programs for promoting better fertilizer application practices.

Aurangozeb (2002) observed that there was significant negative relationship among age and use of integrated homestead farming technologies. The interpretation is that with increased age level of the respondents there was a corresponding decrease of the adoption of homestead farming technologies as well as has a relation with fertilizer use.

Muttaleb (1995) studied the relationship of education with use gap improved potato technologies. The study observed that education had a positive relationship with their adoption potato technologies and that was very helpful.

Afrad *et al.* (2021) had a study which was conducted to investigate the adoption of IPSA seem and BU pepe1 crop variety by the farmers in Bhaluka upazila of Mymensingh and Meherpur Sadar upazila of Meherpur districts, respectively in Bangladesh. According to study findings, the highest portion of the respondents were young aged, literate, had medium farm size, low farming experience, and organizational participation and their average annual income were Tk. 1,92,850 and Tk. 2,00,500 for IPSA seem and BU pepe1 growers, respectively. Extent of adoption was above fifty percent in both cases of IPSA seem and BU pepe1 whereas the extent of BU pepe1 adoption was higher than Majority of them had a low to moderate knowledge gap in cultivating IPSA seem and BU pepe1. The study results showed that respondents with small farm sizes were more interested in adopting IPSA seem than others. So, engaging small farmers in cultivating IPSA seem would make this technology more available and popular among the farmers. This study helped me to understand wheat technology.

Rashid *et al.* (2019) did a study on rice production technology adoption requires effective farmers' training for narrowing knowledge gap. This paper assesses the result of community training on the extent of adoption of improved rice production practices in low land rice of south western Bangladesh. The integration of other extension methods such as method and result demonstration might enhance the rate of adoption of those rice production technologies. This study showed that farmers characteristics highly related to their use gap.

Hossain (1981) conducted a study on relationships of selected characteristics of the Jute growers with their knowledge gap of improved practices of Jute cultivation. He found that there is no relationship between attitude towards intensive Jute cultivations scheme of the Jute growers and their adoption of improved practices of jute cultivation at that time. It relates the current study.

Pesticides pose serious threats to both human health and the environment. In Europe, farmers are encouraged to reduce their use, and in France a recent environmental policy fixed a target of halving the pesticide use by 2018. Organic and integrated cropping systems have been proposed as possible solutions for reducing pesticide use, but the effect of reducing pesticide use on crop yield remains unclear. Here we can see that farmer's behavior of using inorganic fertilizer is more likable rather than using organic pesticide. (Hossard *et al.*, 2014)

Low adoption of improved agricultural practices is one of the major challenges to improve food security. A case study was carried out to assist the farmer's fertilizer application gap in rice cultivation in Nepal. The rates of fertilizers use were assessed in relation to farm size, crop variety, irrigation etc. The applications of both organic and mineral fertilizers vary highly by farmer type. Small and medium farmers applied twice the amount of organic manure compared to large farmers. For inorganic fertilizer use, large farmers applied higher amounts of nitrogen (N) fertilizer compared to medium and small farmers. Across farmer types, a higher amount of N and P fertilizers was used for hybrid varieties than inbred varieties and in irrigated fields than in rain fed fields. The use of potassium (K) fertilizer was low and not affected by farmer type or variety. Overall, farmers used a lower amount of N and K and a higher amount of P than the recommendation. The imbalanced use of fertilizers was associated with poor access to agricultural extension services. Variations of fertilizer use among farmers and the role of extension in the adoption of improved practices are still under researched, and hence this study exposes the need to investigate in depth knowledge, determinants of fertilizer use and role of extension education.

Results from this study could be important to develop an innovative extension program using multiple channels to increase farmers' access to and awareness regarding balanced use of fertilizers to increase soil fertility and crop productivity. Specially crop like wheat (Baral *et al.,* 2019*)*.

Sardar (2002) conducted on "adoption of IPM practices by the farmers under PETRRA Project of RDRS. He observed that majority (45.9%) of the farmers had medium, 38.3 percent had low and 15.8 percent had high adoption of IPM practices.

2.3 The Conceptual Framework of the Study

In scientific research, selection and measurement of variables constitute on important job. A hypothesis of a research while constructed properly contains at least two important elements i.e. "a dependent variable" and "an independent variable". A dependent variable is that factor which appears, disappears or varies as the researcher introduces, removes or varies the independent variables as his will (Townsend, 1953). An independent variable is that factor which is manipulated by the researcher in his attempt to be ascertain its relationship to an observed phenomenon. In view of prime findings of review literature, the researcher constructed a conceptual frame work toward the study which is self-explanatory and is presented in Fig. 2.1 below –

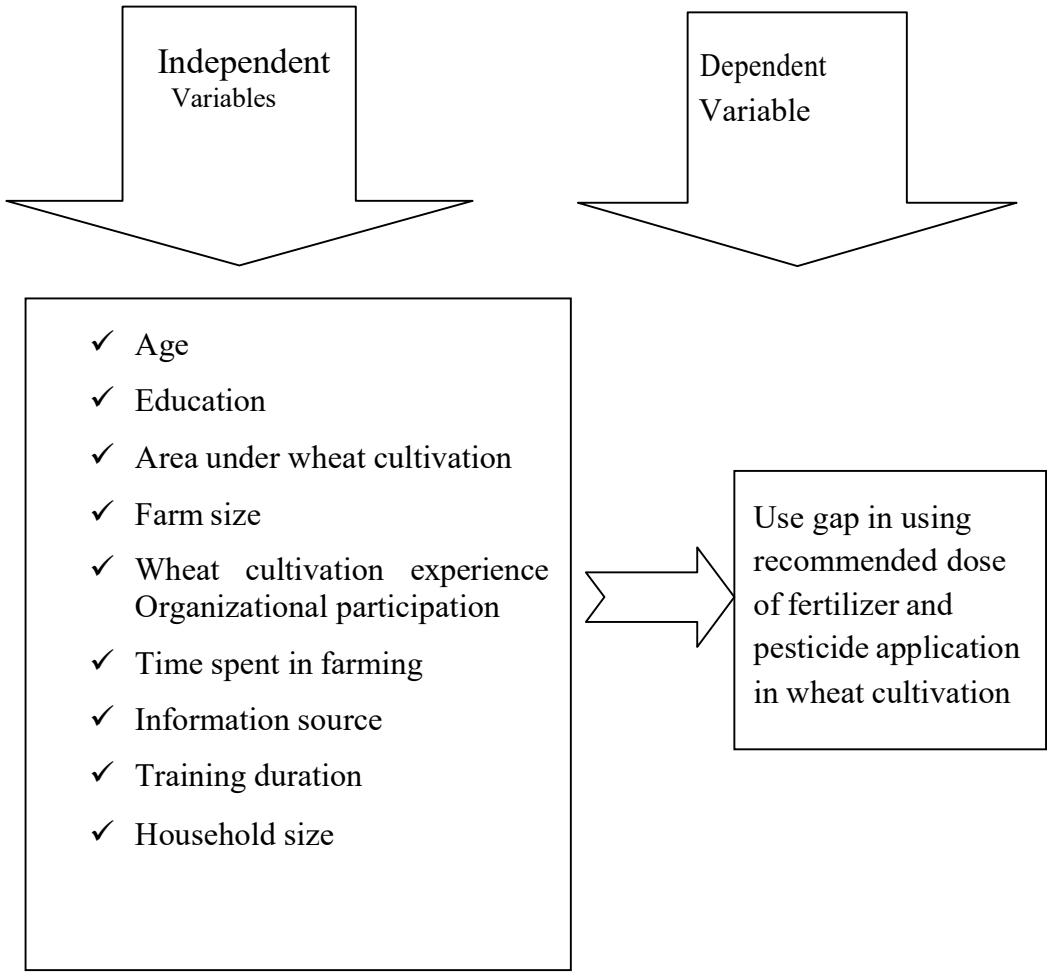

Fig. 2.1 A conceptual framework of the study

CHAPTER III

METHODOLOGY

In any scientific research. methodology plays an important role. Appropriate methodology helps the researcher to collect valid and reliable intonation and analyze the information properly in order to arrive at correct and meaningful conclusion. Methods and procedures that were followed in this study have been descried below:

3.1 Locale of the study

Wheat growers can be found in all upazilas of Thakurgaon District. Thakurgaon (*Thakurgaon Jela* also *Thakurgaon Zila*) is a district in the north-western side of Bangladesh. It is a part of the Rangpur Division and borders India to the west. It was established as a mahakuma in 1860 consisting of 6 thanas named Thakurgaon sadar, Baliadangi, Pirganj, Ranishankail, Haripur and Ruhia. There are five Upazilals. Among these upazillas, the Sadar upazilla was selected as the locale of the study. Sadar Upazila consists of 22 unions. Four villages (Debidanga, Maddha jhargaon, Uttar Jhargaon, Dokkhin Botina) from the three unions (Akcha, Akhanagar, Baragaon) were purposively selected for conducting the survey. The maps showing the locale of the study are presented in the fig. 1 and fig. 2 below:

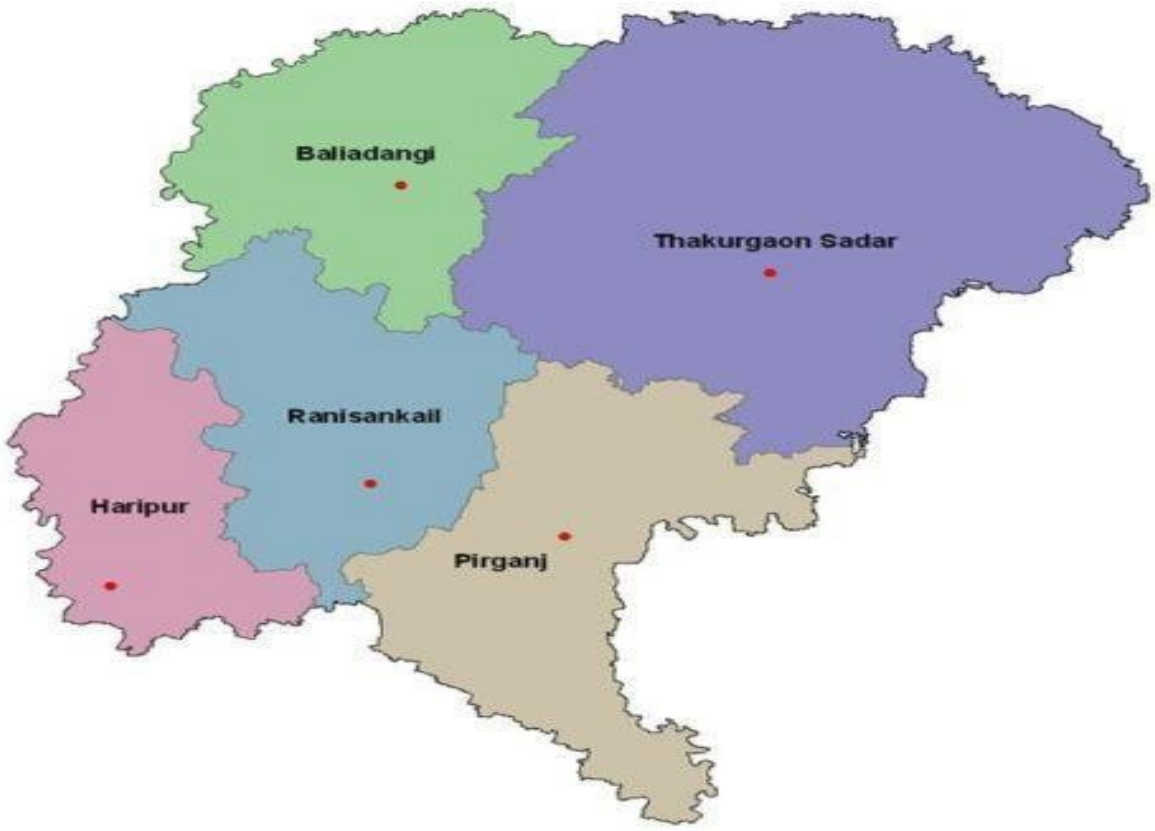

Fig. 1: A map showing the Sadar Upazilla in Thakurgan district

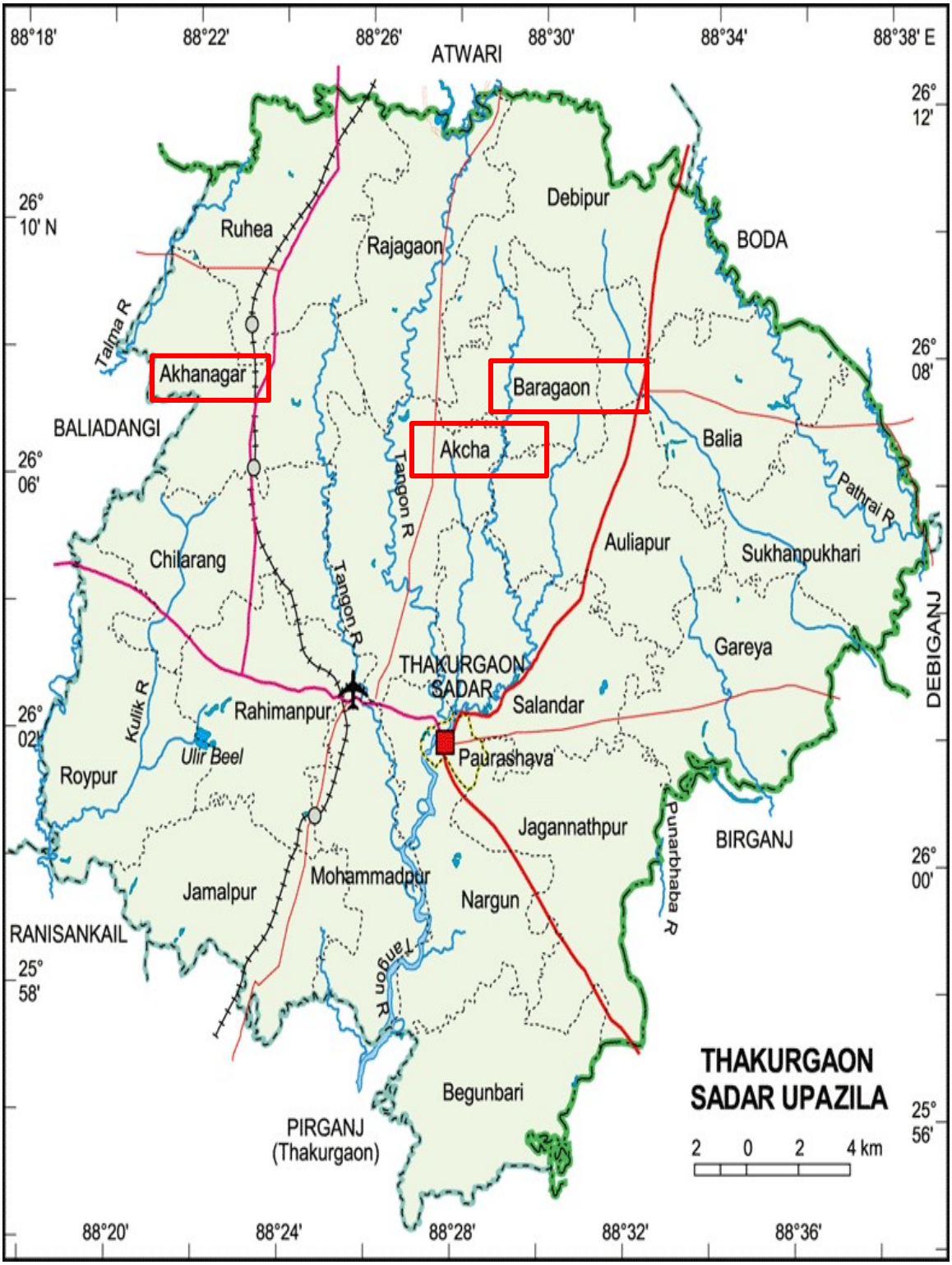

Fig. 2. A map showing the unions of the study area in Thakurgaon Sadar

3.2 Population and Sample Size

The number of wheat growers in the selected villages was 668. These wheat growers constituted the population of the present study. At the rate of 15 percent of population, 100 wheat growers were selected randomly as sample size, who were considered to be representative of the whole population. Data were collected from the sample using a pre-tested interview schedule. Besides, at the rate 5 percent of the population, 34 wheat growers were selected from the population as reserved respondents who were supposed to be interviewed only when respondents in the original list found unavailable during data collection. The distribution of the population and the randomly drown sample size as well as a reserve list of the wheat growers are shown in Table 3.1.

Table 3.1 Measurement of sample size

Name of the Upazilla	Name of the unions	Name of the villages	Total Wheat Grower (Population)	Sample Size	Reserve List Size
Sadar	Akcha	Debidanga	180	27	9
	Akhanagr	Dakkhin Botina	140	21	7
	Baragaon	Maddha Jhargaon	154	23	8
		Uttar Jhargaon	194	29	10
Total			668	100	34

3.3 Selection of Variables

The researcher visited the study area and talked to the wheat growers before setting the variables of the study, and was able to observe the selected characteristics of the wheat growers which might have influence on knowledge gap in use of wheat

cultivation technologies. The researcher selected nine variables consisting of personal and socioeconomic characteristics of the wheat growers of which nine were independent variables and the remaining one was dependent variable. The independent variables were: age, education, farm size, area under wheat cultivation, time spent in farming, wheat cultivation experience, using information sources, training exposure, and household size. On the other hand, the dependent variable of the study was "use gap in use of wheat cultivation technologies". The technologies were-

1. Recommended doses of fertilizers, and
2. Recommended doses of pesticides

3.4 Measurement of Variables

For conducting the study as per the objectives determined, it was necessary to measure the selected variables. This section contains procedures for measurement of both independent as well as the dependent variables of the study. The procedures followed in the study in measuring the variables are presented below:

3.4.1 Measurement of Independent Variables

In this study selected personal, economic, and social characteristics of the wheat growers were considered as the independent variables. Measurement of these characteristics is as follows:

3.4.1.1 Age

The ages of the respondents were recorded in years and categorized in three categories.

3.4.1.2 Education

The variable – education was categorized in accordance with the level of education of the respondents and scored thereby.

3.4.1.3 Farm size

The farm size of a wheat grower was calculated by employing the following formula:

$$Farm\ Size = A1 + A2 + \frac{1}{2}(A3 + A4) + A5$$

Where,

A1 = Own homestead

A2 = Own land under cultivation

A3 = Own land given on borga to others

A4 = Land taken on borga from others

A5 = Land taken on lease from others

Famers provided the amount of land information in the local units. Later on, the units were converted to hectare. The lands under wheat cultivation were categorized in five categories according to the size of the lands.

3.4.1.4 Area under wheat cultivation

The amount of land for wheat cultivation by a wheat grower was measured by summing up the lands allotted for wheat production. The farmers provided information in local measuring units regarding the amount of land. Later on, these were converted into hectare. The amount of land in hectare was taken as the 'area under wheat cultivation' score of the respondents.

3.4.1.5 Wheat cultivation experience

Wheat cultivation experience was measured in terms of years since the respondent started wheat cultivation.

3.4.1.6 Time spent in farming

Total farming experience by a farmer was recorded in hours per week and was split in three sections. A score of one was assigned for one hour spent in farming.

3.4.1.7 Use of information source

Five sources of information (SAAO, AEO, Model Farmer, Neighbor, and Fertilizer-Pesticide dealers) were supposed to provide the information to wheat growers regarding wheat cultivation technologies. On the basis of the information source using frequency, the allotted categories were – Regularly (≥6 times), Occasionally (4 to 5 times), Rarely (1 to 3 times), and Never (0 times). For regular, occasional, rare and no contact, the assigned scores were 3, 2, 1 and 0, respectively. Therefore, the highest score a wheat grower can earn by making regular contact with all of the five information sources is 15. Whereas the lowest possible score is 0 when a farmer makes no contact with the information sources. That's why the final scale for measuring the information source using frequency is 0 to 15. In this case, the final categories were determined as follows:

3.4.1.8 Training duration

Training duration of a respondent was measured by the number of days that he/she had received training related to wheat cultivation in till the day of survey interview. A score of 1 was assigned for each day of received training related to wheat cultivation. It was indicated by the total number of days of receiving agricultural training by a respondent under different training programs. For example, if a respondent attended training programs for 4 days, his/her training exposure score would be 4.

3.4.1.9 Household size

Household size of the respondents were recorded and categorized in three different categories. The respondents provided the number of family members and a score of one was given for each family member.

3.4.2 Measurement of the dependent variable

Wheat farmers' use gap on recommended dose of fertilizer and pesticide was dependent variable of the study. It was measured based on score, the score was calculated on specific fertilizer and pesticide those were applied in wheat cultivation. The fertilizers are Urea, TSP, and MoP and pesticides are Tilt 250 EC and Provax-200. The measurement was done in three stages.

First Stage: Farmers' use gap on fertilizer was calculated by making difference between recommended dose and used dose of Urea, TSP and MoP. Then it was converted into percentage. After that the use gap of fertilizer was calculated by summing three fertilizer score.

$$\text{Use } Gap\ on\ Fertilizer = \frac{\text{Use } gap\ on\ Urea + \text{Use } gap\ on\ TSP + \text{Use } gap\ on\ MoP}{3}$$

Second Stage: Farmers' use gap on pesticide was calculated by making difference between recommended dose and used dose of Tilt 250 EC and Provax-200. Then it was converted into percentage. After that the use gap ofpesticide was calculated by summing two pesticide score.

$$\text{Use } Gap\ Pesticide = \frac{\text{Use } gap\ on\ Tilt\ 250\ EC + \text{Use } gap\ on\ Provax - 200}{2}$$

Third Stage: The overall use gap of the wheat growers was calculated by adding the individual use gap on fertilizer and pesticide using the followingformula.

$$\text{use } Gap = \frac{\text{use } gap\ on\ fertilizer + \text{use } gap\ on\ pesticide}{2}$$

3.5 Instrument for Data Collection

In order to collect relevant information from the respondents, an interview schedule was used. The schedule was carefully designed keeping the objectives of the study in view. The schedule contained both open and closed form of questions. Easy, simple, direct questions and different scales were used to obtain the information. The questions were arranged systematically and presented clearly so that the respondents could understand furnishing information in a consistent and systematic manner. The interview schedule was prepared in Bengali language for better understanding of the respondents. The interview schedule was pre-tested with 15 wheat growers of the study area. The pre-test facilitated the researcher to examine the suitability of the different questions and statements of the interview schedule in general. Afterwards. The interview schedule was finally prepared with necessary corrections, modifications and alterations as per experience of the pre-test. An English version of the interview schedule is enclosed at Appendix-I.

3.6 Collection of Data

Data for this study were collected personally by the researcher herself through face-to-face interview from selected respondents. The interview schedule prepared earlier by the researcher was used to gather information. All possible efforts were made to explain the purpose of the study to the respondents in order to get valid and pertinent information. Interviews were conducted with the respondents at their homes. While starting interview with any respondent, the researcher took all possible care to establish rapport with them so that they could feel easy to furnish proper responses to the questions and statements in the interview schedule. The questions were explained and clarified whenever any respondent felt difficulty in understanding properly. None of the wheat growers was interviewed from the reserve list during final collection of data. The entire process of collecting data took place during November 01 to December 01, 2021.

3.7 Statement of Hypothesis

As defined by Goode and Hatt (1952) “A hypothesis is a proposition which can be put to a test to determine its validity. It may seem contrary to, or in accord with common sense. It may prove to be correct or incorrect. In any event, even though, it leads to an empirical test”.

The following hypothesis is formulated to explore the relationship between the dependent variable and independent variables. The major research hypothesis for the study is “there is no relationship between farmers’ use gap of wheat cultivation and their selected characteristics including Age, Education, Area under wheat cultivation Farm size, Wheat cultivation experience Organizational participation, Total farming experience, Information source using frequency, Training duration, Household size and use gap in using wheat cultivation technologies.”

The research hypothesis was converted into null form of the purpose for statistical testing. The major null hypothesis states that “There is relationship between farmers’ use gap on recommended dose of fertilizer and pesticide in wheat cultivation and their selected characteristics”. Nine null hypotheses were formulated dealing with each of the selected characteristics.

3.8 Compilation of Data

After completion of field survey all the data of the interview schedule were compiled. Local units were converted into standard unit. Appropriate coding and scoring technique were followed to convert the qualitative data into quantitative forms. The responses of the individual respondent contained in the interview schedules were transferred to a master sheet for entering the data in the computer.

After entering the data into computer, it was analyzed in accordance with the objectives of the study.

3.9 Statistical Analysis

Simple Statistics like frequency, percentage. rank order. mean and standard deviation were used to perform data analysis. For clarity of understanding tables were used to present the data. For exploring the contributing relationships between the selected characteristics of the respondents and knowledge gap in use of wheat production technologies, multiple linear regression was performed. Data were analyzed by using the software package named SPSS.

CHAPTER IV
RESULTS AND DISCUSSION

In this Chapter. the findings of the study and interpretation of results have been presented. Collected data were carefully edited, coded, computed. tabulated and analyzed in accordance with the objectives of the study. This chapter is divided into three sections. In the first section. the independent variables (selected characteristics of the wheat growers) have been discussed. The second section deals with the knowledge gap of wheat growers in use of recommended dose of fertilizer and pesticide, which is the dependent variable of the study. The third section deals with the relationships between selected characteristics of the wheat growers and their knowledge gap in use of recommended dose of fertilizer and pesticide.

4.1 Selected Characteristics of the Wheat Growers

This section deals with the characteristics of wheat growers which were assumed to be associated with the knowledge gap in use of wheat production technologies. The selected characteristics were age, education, farm size, area under wheat cultivation, wheat cultivation experience, wheat cultivation experience, time spent in farming, using information source, training duration and household size. The study thinks that the knowledge gap of wheat growers in use of wheat production technologies (fertilizers and pesticides) would also be influenced by the selected characteristics of the wheat growers. Measuring units, ranges, means and standard deviations of the characteristics of wheat growers are described in this section. Table 4.1 gives a summary of the profile of the wheat growers' characteristics.

Table 4.1 Wheat Growers' Characteristics Profile

Sl. No.	Characteristics	Measuring Unit	Possible Range	Observed Range	Mean	Standard Deviation
1.	Age	Years	Unknown	28-67	46.05	8.90
2.	Education	Scoring	0-20	0-20	9.90	7.45
3.	Farm Size	Hectare	Unknown	0.12-2.23	0.54	0.50
4.	Area Under Wheat Cultivation	Hectare	Unknown	0.07-2.125	0.47	0.50
5.	Wheat Cultivation Experience	Years	Unknown	5-25	14.01	4.54
6.	Time Spent in Farming	Years	Unknown	9-38	22.52	5.90
7.	Use of Information Source	Scoring	0-15	0-10	8.39	1.66
8.	Training Duration	Scoring	Unknown	0-4	2.54	1.04
9.	Household Size	Scoring	Unknown	3-7	5.0	0.99

4.1.1 Age

Age of the farmers ranged from 28 to 67 years, with the mean age of 46.05 years and the standard deviation of 8.90. The distribution of the wheat growers according to their age is shown in Table 4.2.

Table 4.2 Distribution of the wheat growers according to their age

Categories	Basis	Wheat Growers	
		Number	Percent
Young adults	20-39	26	26
Middle-aged adult	40-59	67	67
Old adults	≥60	7	7
Total		100	100

Table 4.2 shows that the two third of the wheat growers are middle aged adults. The second highest proportion (26%) was followed by the young adults. Only 7% of the wheat growers were old adults. This finding suggests that in the study area, the young and old adults are less involved in wheat cultivation than the middle-aged adults. It might be due to the involvement of young adults more in education, business, other crops cultivation etc. It also can be inferred that middle-aged adults are more energetic and experienced in agriculture, thereby, in wheat cultivation.

4.1.2 Education

The education scores of the farmers ranged from 0 to 20. The average score was 9.90 and the standard deviation was 7.45. The distribution of the farmers according to their education is shown in Table 4.3.

Table 4.3 Distribution of the farmers according to their education

Categories	Basis	Wheat Growers	
		Number	Percent
Cannot read or write	0	28	28
Primary Education	10	45	45
Above Primary Education	20	27	27
Total		100	100

From the table above, it is obvious that still 28% of the wheat growers in the study region are illiterate. Among the rest, 45% had admitted to or completed primary education and 27% had secondary education or above. Therefore, the

literacy rate of the wheat growers in the area is 72% which is well over the average literacy rate (41.8%) of Thakurgaon district (Banglapedia, 2021) and slightly below the adult average literacy rate of Bangladesh (74.9%) (Knoema, 2021). The reason behind the low percentage of secondary education or above secondary education and high primary education percentage might be due to the fact that the farmers enter their profession by inheritance and felt less necessity for gaining formal education for farming.

4.1.3 Farm size

Farm size of the respondents varied from 0.12 ha to 2.23 ha. The average farm size was 0.54 ha with a standard deviation of 0.54. The distribution of the wheat growers according to farm size is shown in Table 4.4.

Table 4.4 Distribution of the farmers according to their farm size

Categories	Basis	Wheat Growers	
		Number	Percent
Small	0 to 0.20	21	21
Medium	0.21 to 0.4	61	61
Large	>0.4	18	18
Total		100	100

In the study, it was found that 21% of the wheat growers fell under the category 'small', whereas, majority of the farmers (61%) were reported to be under the category 'medium'. On the other hand, 18% of the wheat growers were found to be categorized as large farmers. These findings were considerably different from that of Zahan (2010) in respect of wheat grower's percent and mean value.

4.1.4 Area under wheat cultivation

Area under wheat cultivation of the respondents varied from 0.07 ha to 2.125 ha. The average farm size was 0.47 ha with a standard deviation of 0.50. The distribution of the wheat growers according to area under wheat cultivation is shown in Table 4.5

Table 4.5 Distribution of the farmers according to area under wheat cultivation

Categories	Basis	Wheat Growers	
		Number	Percent
Small	0 to 0.20	25	25
Medium	0.21 to 0.4	59	59
Large	>0.4	16	16
Total		100	100

In the study, it was found that over 80% of the wheat growers were under the categories of small and medium with the greater percentage of 59% in the medium category. In the study area, 16% of the wheat growers were found to be categorized as large farmers. These findings were considerably different from that of Zahan (2010) in respect of wheat grower's percent and mean value possibly due to the fact that the farmers of the current study area are more interested in wheat cultivation due to weather and climatic advantages.

4.1.5 Wheat cultivation experience

Wheat cultivation experience of the respondents varied from 5 to 25 years. The average farm size was 14.01 ha with a standard deviation of 4.54. The distribution of the wheat growers according to wheat cultivation experience is shown in Table 4.6.

Table 4.6 Distribution of the farmers according to wheat cultivation experience

Categories	Basis	Wheat Growers	
		Number	Percent
Low exp.	0.1 to 5	3	3
Medium exp.	6 to 10	18	18
High exp.	>10	79	79
Total		100	100

An overwhelmingly large percentage (79%) of the wheat growers in the study area were recorded to be highly experienced in wheat cultivation. The percentage

of the wheat growers with medium and low experience was 18% and 3%, respectively. The wheat growers having longer wheat cultivation experience might have valuable opinions regarding wheat cultivation. The government and private extension agents can make use of these views and opinion in designing their extension activities.

4.1.6 Time spent in farming

Total farming experience of the respondents varied from 9 to 38 hours. The mean time spent in farming was 22.52 with a standard deviation of 5.90. The distribution of the wheat growers according to time spent in farming is shown in Table 4.7.

Table 4.7 Distribution of the farmers according to total farming experience

Categories	Basis	Wheat Growers	
		Number	Percent
Low	01-15	9	9
medium	16-30	87	87
high	>30	4	4
Total		100	100

An overwhelmingly large percentage (87%) of the wheat growers in the study area were recorded to have medium time spent in farming activities measured in hours. The percentage of the wheat growers with high and low time spent in farming was 4% and 9%, respectively. This finding infers that almost all of the farmers in the study area from the categories of ‘medium’ and ‘high’ experience in farming are highly experienced in wheat cultivation.

4.1.7 Use of information source

Wheat cultivation information source using frequency of the respondents varied from 0 to 10. The average information source using frequency was 8.39 with a

standard deviation of 1.66. The distribution of the wheat growers according to wheat cultivation information source using frequency is shown in Table 4.8.

Table 4.8 Distribution of the farmers according to wheat cultivation information source using frequency

Categories	Basis	Wheat Growers	
		Number	Percent
Never	0	2	2
Rarely	1 to 5	1	1
Occasionally	6 to 10	97	97
Regularly	11 to 15	0	0
Total		100	100

In the study, it was found that almost all of the wheat growers (97%) met information sources regarding wheat cultivation. Only 2% of the respondents reported that they never used information sources and 1% reported that they rarely used the information sources. No respondent was recorded to have a regular contact with the information sources used in the study. This finding infers that the wheat growers of this area are moderately conversant in using information sources.

4.1.8 Training duration

Exposure to training of the respondents varied from 0 to 4. The average training duration was 2.54 with a standard deviation of 1.04. The distribution of the wheat growers according to training duration is shown in Table 4.9.

Table 4.9 Distribution of the farmers according to training duration

Categories	Basis	Wheat Growers	
		Number	Percent
No Training	0	2	2
Very Low Training	1 to 2	36	36
Low Training	3 to 4	62	62
Total		100	100

In the current study, 62%, 36% and 2% of the respondents were reported to be exposed to low, very low and no training. This result expresses that the wheat growers in the study area have low opportunities to participate in wheat cultivation training programs. This might be happened due to less training providing activities by the extension agents. There is a scope for the agricultural extension officers to arrange more training for more proper practical knowledge in wheat cultivation of the wheat growers.

4.1.9 Household Size

Household size of the respondents varied from 3-7. The average household size was 5 with a standard deviation of 0.994. The distribution of the wheat growers according to household size is shown in Table 4.10

Table 4.10 Distribution of the farmers according to household size

Categories	Basis	Wheat Growers	
		Number	Percent
Small	2-3	7	7
Medium	4-5	71	71
Large	≥6	22	22
Total		100	100

More than 70% of the wheat growers had medium size household. Only 7% of the respondents had small household. However, the percentage of large household holders was fairly high (22%). Apparently, household size may not have link with wheat cultivation use gap. But in the study area, it was hypothesized to have a relation between household size and use gap.

4.2 Use gap on fertilizers and pesticides doses in wheat production

The overall use gap on fertilizer and pesticide dose scores of the wheat growers ranged from 0 to 53 having an average of 37.34 and a standard deviation of 6.76 against the possible range of 0-15. The distribution of the wheat growers according to their overall use gap on fertilizer and pesticide dose is shown in Table 4.11.

Table 4.11 Distribution of the wheat growers according to their use gap on use of fertilizer and pesticide dose

Categories	Range	Wheat Growers		Mean	STDEV
		Number	Percent		
No UG	0	3	3	37.34	6.76
Low UG	1 to 25	49	49		
medium UG	26 to 50	30	30		
High UG	≥51	18	18		
Total		100	100		

(UG= Use Gap)

In the study, it was found that 3% of the wheat growers had no use gap on using recommended doses of fertilizers and pesticides. Nearly half (49%) of the wheat growers had low knowledge gap. That means, a total of 52% of the wheat growers in the study area had satisfactorily good use about the recommended doses of fertilizers and pesticides to be used in wheat cultivation. However, 30% and 18% of the respondents showed medium and high use gap. Therefore, about 50% of the wheat growers in the region are still needed to be provided with the appropriate of use of using fertilizers and pesticides in wheat cultivation.

4.3 Relationship between the Selected Characteristics of the Wheat Growers and their Use Gap in Use of Fertilizers and Pesticides doses in Wheat Cultivation

In order to find the strength of relationship between an independent variable and the dependent variable – use gap in use of fertilizer and pesticide doses in wheat cultivation by wheat growers, the multiple regression analysis was performed shown in the table 4.12 below.

Table 4.12 Multiple regression coefficients of the contributing variables related to the gap of in use of fertilizers and pesticides in wheat cultivation

Dependent Variable	Independent Variables	β	Sig.	R^2	Adjusted R^2	F
Knowledge gap in using wheat cultivation technologies	Age	.049	$.709^{NS}$	.58	.54	14.31
	Education	-.218	$.009^{**}$			
	Farm size	-.133	$.953^{NS}$			
	Area Under Wheat Cultivation	.193	$.932^{NS}$			
	Wheat Cultivation Experience	-.361	$.001^{**}$			
	Time Spending in Farming	-.330	$.003^{**}$			
	Using Information Source	-.362	$.001^{**}$			
	Training Duration	-.442	$.001^{**}$			
	Household Size	-0.043	0.654^{NS}			

NS = Not significant

*= Significant at 0.05 level of probability

**= Significant at 0.01 level of probability

Among the nine variables, five variables namely education, wheat cultivation experience, time spent in farming, using information source and training duration were found to have a significant influence to the use gap in using recommended dose of fertilizers and pesticides at both 1% and 5% level of significance. The remaining four variables, age, farm size, area under wheat cultivation and household size were found to have non-significant influence at both 1% and 5% level of significance. The R-squared value was found to be 0.58which tells that the model is precisely fitted for. The variables altogethercontributed 54.0% of the variance of their adaptive capacity towards use gap (adj. R^2=54%). The overall model was found significant (F-14.31).

4.3.1 Contribution of education to the use gap in using fertilizer andpesticide dose:

The Contribution of wheat cultivation experience to the use gap in using fertilizer and pesticide doses was measured by testing the following null hypothesis; "there is no contribution of education to the use gap in using fertilizer and pesticide doses ".

The adjusted p value of the concerned variable was found 0.009. The following observations were made on the basis of the value of the concerned variable of the study under consideration.

The contribution of education was significant at both 5% and 1% level. So, the null hypothesis could be rejected.

Unstandardized coefficients are the 'raw' coefficients created by the regression analysis when the analysis is performed on the original unstandardized variables. The unstandardized coefficient represents the amount of change of the dependent variable Y due to the change of 1 unitof the independent variable X. A standardized beta coefficient compares the strength of the influence of each independent variable to the dependent

variable. The higher the absolute value of the beta coefficient, the stronger the effect. From the Table 4.12 standardized beta coefficient -0.218. It represents the negative effect of education to the use gap in using fertilizer and pesticide doses. Lower the level of education, higher the use gap and vice versa.

4.3.2 Contribution of wheat cultivation experience to the use gap in using fertilizer and pesticide dose:

The Contribution of wheat cultivation experience to the use gap in using fertilizer and pesticide doses was measured by testing the following null hypothesis; "there is no contribution of wheat cultivation experience to the use gap in using fertilizer and pesticide doses ".

The adjusted p value of the concerned variable was found 0.001. The following observations were made on the basis of the value of the concerned variable of the study under consideration.

The contribution of wheat cultivation experience was significant at both 5% and 1% level. So, the null hypothesis could be rejected.

Unstandardized coefficients are the 'raw' coefficients created by the regression analysis when the analysis is performed on the original unstandardized variables. The unstandardized coefficient represents the amount of change of the dependent variable Y due to the change of 1 unitof the independent variable X. A standardized beta coefficient compares the strength of the influence of each independent variable to the dependent variable. The higher the absolute value of the beta coefficient, the stronger the effect. From the Table 4.12 standardized beta coefficient -0.361. It represents the negative effect of wheat cultivation experience to the use gap in using fertilizer and pesticide doses. Lower the wheat cultivation experience, higher the use gap and vice versa.

4.3.3 Contribution of time spent in farming to the use gap in using fertilizer and pesticide dose:

The Contribution of total farming experience to the use gap in using fertilizer and pesticide doses was measured by testing the following null hypothesis; "there is no contribution of total farming experience to the use gap in using fertilizer and pesticide doses ".

The adjusted p value of the concerned variable was found 0.003. The following observations were made on the basis of the value of the concerned variable of the study under consideration.

The contribution of total farming experience was significant at both 5% and 1% level. So, the null hypothesis could be rejected.

Unstandardized coefficients are the 'raw' coefficients created by the regression analysis when the analysis is performed on the original unstandardized variables. The unstandardized coefficient represents the amount of change of the dependent variable Y due to the change of 1 unitof the independent variable X. A standardized beta coefficient compares the strength of the influence of each independent variable to the dependent variable. The higher the absolute value of the beta coefficient, the stronger the effect. From the Table 4.12 standardized beta coefficient -0.330. It represents the negative effect of total farming experience to the use gap in using fertilizer and pesticide doses. Lower the total farming experience, higher the use gap and vice versa.

4.3.4 Contribution of using information source to the use gap in using fertilizer and pesticide dose:

The Contribution of wheat cultivation information source using frequency to the use gap in using fertilizer and pesticide doses was measured by testing the following null hypothesis; "there is no contribution of wheat cultivation information source using frequency to the use gap in using fertilizer and pesticide doses ".

The adjusted p value of the concerned variable was found 0.001. The following observations were made on the basis of the value of the concerned variable of the study under consideration.

The contribution of wheat cultivation information source using frequency was significant at both 5% and 1% level. So, the null hypothesis could berejected. Unstandardized coefficients are the 'raw' coefficients created by the regression analysis when the analysis is performed on the original unstandardized variables. The unstandardized coefficient represents the amount of change of the dependent variable Y due to the change of 1 unitof the independent variable X. A standardized beta coefficient compares the strength of the influence of each independent variable to the dependent variable. The higher the absolute value of the beta coefficient, the stronger the effect. From the Table 4.12 standardized beta coefficient -0.362. It represents the negative effect of wheat cultivation information source using frequency to the use gap in using fertilizer and pesticide doses. Lower the wheat cultivation information source using frequency, higher the use gap and vice versa.

4.3.5 Contribution of training duration to the use gap in using fertilizer and pesticide dose:

The contribution of training duration to the use gap in using fertilizer and pesticide doses was measured by testing the following null hypothesis; "there is no contribution of training duration to the use gap in using fertilizer and pesticide doses ".

The adjusted p value of the concerned variable was found 0.001. The following observations were made on the basis of the value of the concerned variable of the study under consideration.

The contribution of training duration was significant at both 5% and 1% level. So, the null hypothesis could be rejected.

Unstandardized coefficients are the 'raw' coefficients created by the regression analysis when the analysis is performed on the original unstandardized variables. The unstandardized coefficient represents the amount of change of the dependent variable Y due to the change of 1 unitof the independent variable X. A standardized beta coefficient compares the strength of the influence of each independent variable to the dependent variable. The higher the absolute value of the beta coefficient, the stronger the effect. From the Table 4.12 standardized beta coefficient -0.442. It represents the negative effect of training duration to the use gap in using fertilizer and pesticide doses. Lower the training duration, higherthe use gap and vice versa.

CHAPTER V

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the summary of findings, conclusions and recommendations of the study.

5.1 Summary of the Findings

The summary of the major findings is presented in the following three subsections:

5.1.1 Selected Characteristics of Wheat growers

Age

Majority of the wheat growers (67%) were middle-aged adults. The percentage of young adults and old adults were 26% and 7%, respectively.

Education

Of the respondents, 45% had primary education, 28% couldn't read or write and 27% had above primary level education.

Farm Size

Majority of the wheat growers were found to have medium amount of land (61%). The proportion of farmers under small and large categories were 21% and 18%, respectively.

Area under wheat cultivation

Majority of the wheat growers were found to have medium amount of land (59%). The proportion of farmers under small and large categories were 25% and 16%, respectively.

Wheat cultivation experience

An overwhelmingly large percentage (79%) of the respondents were highly experienced in wheat cultivation. On the other hand, only 18% and 3% had medium and low experience, respectively.

Time spent in farming

An overwhelmingly large percentage (87%) of the respondents spent medium time in farming per week. On the other hand, only 4% and 9% had high and low time spent in farming, respectively.

Wheat cultivation information source using frequency

Almost all of the respondents (97%) had occasional contact with information sources. Only 2% and 1% respondents were reported to have no contact and rare contact. Surprisingly, no respondent had regular contact with information sources.

Training duration

The percentages of respondents with no training, very low training and low training were 2%, 36%, and 62%.

Household size

Among the respondents, 71% had medium-sized household, 22% had large household, and 7% had small household.

5.1.2 Use gap in use of fertilizers and pesticides

Overall, 49% of the respondents had low use gap, 3% had no use gap, 30% had medium use gap, and 18% had high use gap in use of recommended doses of fertilizers and pesticides.

5.1.3 Relationship between the Selected Characteristics of the Wheat Growers and their use Gap in Use of Fertilizers and Pesticides doses in Wheat Cultivation

Regression analysis indicated that among the nine independent variables, five variables namely education, wheat cultivation experience, time spent in farming, use of information source and training duration were found to have a significant influence to the use gap in using recommended dose of fertilizers and pesticides at both 1% and 5% level of significance. The remaining three variables, age, area under wheat cultivation and household size were found to have non-significant influence at both 1% and 5% level of significance.

5.2 Conclusions

Based on the findings of the study, the following conclusions were made –

1. In the study area, nearly half of the respondents have medium to high use gap regarding the use of recommended dose of fertilizers andpesticides. Therefore, it can be inferred that the still there is a scope to decrease wheat farmers' use gap regarding recommended dose of fertilizer and pesticide.
2. Education was found to have a significant effect on use gap. Higher the education level, lower the use gap regarding recommended dose of fertilizer and pesticide.
3. Wheat cultivation experience was found to have a significant relation with use gap. Farmers having long experience in wheat cultivation tends to lower the use gap of recommended dose of fertilizer andpesticide.
4. Time spent in farming was negatively associated and significant with use gap. Lower time spent in farming results in higher use gap.
5. Wheat cultivation information source using frequency was found to have a negative significant relation with use gap. It means that the

wheat growers who make less contact with the information sources are more prone to higher use gap.

6. Training duration was reported to have a significant relation with use gap. The study infers that for lowering use gap in fertilizer and pesticide use, more and more training programs should be arranged in the area. Training exposure of the farmers in the area was categorized between no training and low training. Therefore, there is a huge scope to work with this variable for decreasing use gap.

5.3 Recommendations

On the basis of findings and conclusion of the study. recommendations are made as follows:

5.3.1 Recommendation for policy implications

1. Extension agents should frequently visit the growers and advise them on wheat cultivation practices. Electronic, printed and inter-personal information media should also be used extensively to create awareness and to reduce use gap in use on wheat production technologies (fertilizers and pesticides).
2. It may be recommended that agricultural extension agencies especially the DAE and relevant NGOs should crucially review training programs and make sound provisions so that the growers understand the need of modern technologies of wheat cultivation to reduce use gap in use of wheat production technologies. At the same time, the frequency of training arrangement should also be increased in the study area.
3. Special care should be taken of the illiterate wheat growers so that they become aware of the benefits of recommended dose of fertilizer and pesticide application in wheat cultivation.
4. The extension agent should contact more with the farmers having less experience and spending less time in farmers to understand the importance of applying agrochemicals in recommended rate in wheat cultivation.

5.3.2 Future recommendations

On the basis of the limitations found in the current study, the following recommendations could be made –

1. The present study was conducted in Akcha, Akhanagar, and Baragaon unions in Sadar Upazila of Thakurgaon district. To arrive at generalizations as to the use gap among the wheat growers in use of fertilizers and pesticides in wheat production in the country and to draw up policy measures for the betterment of the whole nation, similar research efforts are needed at other locations of the country.
2. The current study included eight personal and socio-economic variables to understand the extent of use gap in fertilizer and pesticide use in wheat cultivation. So, inclusion of more variables in the future studiesis recommended.
3. This study involved only two wheat production technologies (fertilizers and pesticides). It is therefore, recommended that further study should he conducted involving other related technologies.

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APPENDICES

AN ENGLISH VERSION OF THE INTERVIEW SCHEDULE

Department of Agricultural Extension and Information System

Sher-e-Bangla Agricultural University, Dhaka, Bangladesh

An interview schedule for a research study entitled

"Farmers' Use Gap on Recommended Dose of Fertilizer and Pesticide in Wheat Cultivation"

Name of the respondent:

Village:

Union:

Upazila:

District:

Mobile Phone Number:

(Please answer the following questions. Provided information will be strictly kept confidential.)

1. Age:

Question: How old are you?Answer:

2. Education:

What is the level of your education?

a) Do not know how to read or write
b) Can sign only
c) Passed class

3. Farm Size:

Please mention the practiced technologies of wheat cultivation

Sl. No.	Type of land use	Area (Decimal)	Area (Hectare)
01.	Own Homestead		
02.	Own land under cultivation		
03.	Own land given on borga to others		
04.	Land taken on borga from others		
05.	Land taken on lease from others		
Total			

4. Area under wheat cultivation:

Question: How much area you cultivated wheat in the last year?Answer:

5. wheat cultivation experience:

Question; How long you are engaged in wheat cultivation?Answer:

6. Extension Contact

Please mention the level of extension contact on the followings

Sl. No.	Information Sources	Use of information sources			
		Regularly (≥6 times/year)	Occasionally (4-5 times/year)	Rarely (1-3 times/year)	Never
1.	Seek advice from SAAO				
2.	Seek advice from AEO/UAO				
3.	Seek advice from model farmer				
4.	Seek advice from neighbor				
5.	Seek advice from fertilizer and pesticide dealer				
Total					

7. Training duration

Have you ever participated in training on use of agrochemicals in wheat production?

a) Yes

b) No

If yes, please mention the followings -

Sl. No.	Topic of training	Duration (Days)	Organizer
1.			
2.			
3.			
Total			

8. Time spent in farming

Question: How much time you spent for wheat cultivation?Answer:

9. Household size:

Please mention your family size

10. Farmer's use gap on fertilizer and pesticide

Please mention your application doses of fertilizer and pesticide in wheat cultivation

Sl. No.	Technologies		Recommended dose	Used dose by farmer	Difference	Percent of difference (PD)
01	Fertilizer	Urea				
		TSP				
		MoP				
02	Pesticides	Tilt 250 EC				
		Provax-200				

$$\textbf{Use } \boldsymbol{Gap} = \frac{\boldsymbol{PD\ of\ fertilize} + \boldsymbol{PD\ of\ pesticide}}{\mathbf{2}}$$

Date: Signature of the interviewer